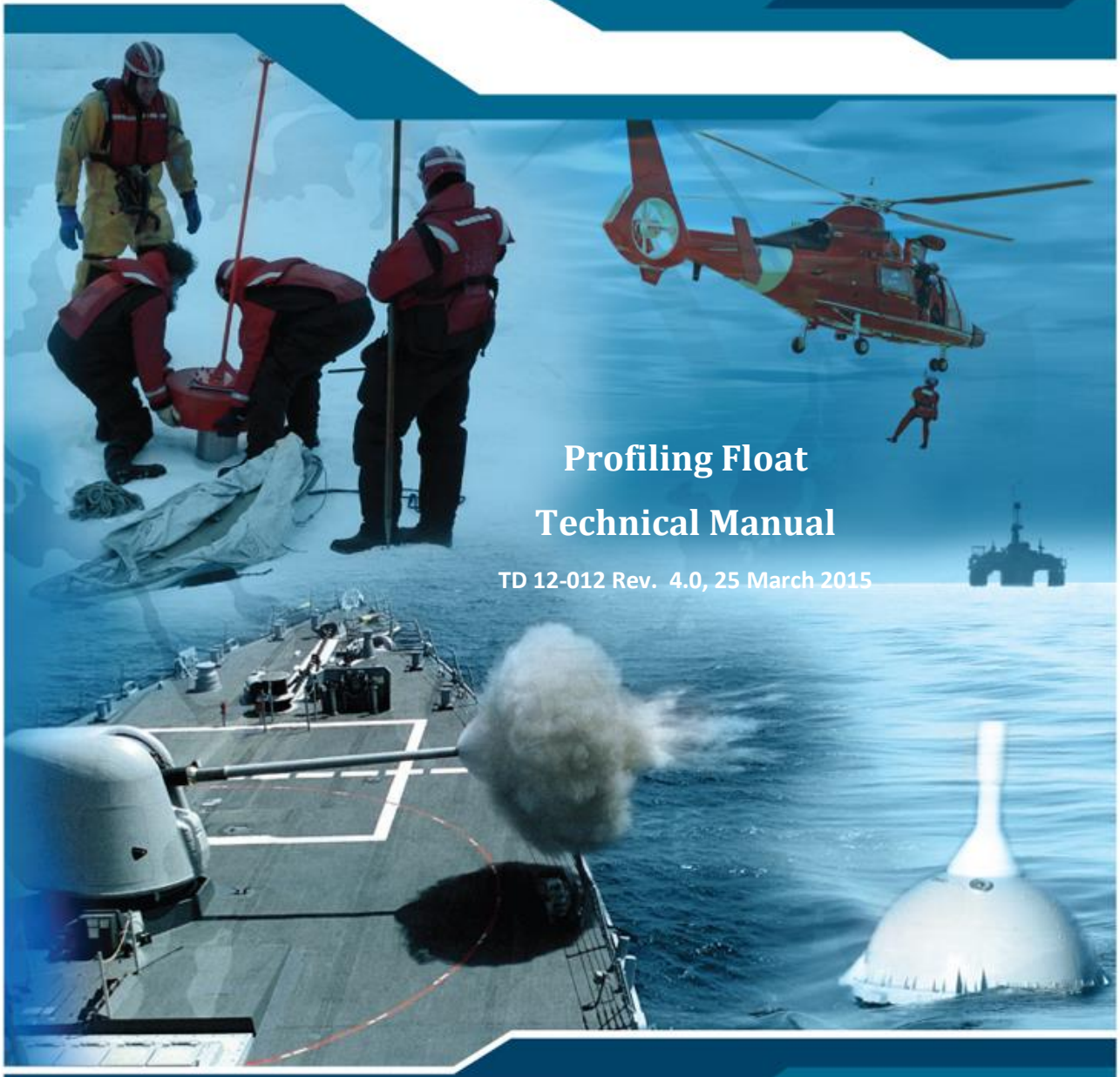
MetOcean



Profiling Float
Technical Manual

TD 12-012 Rev. 4.0, 25 March 2015

Data collection and communication experts

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CONTACT INFORMATION

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Web-site: http://www.MetOcean.com

IMPORTANT - DEVICE ACTIVATION

- Prior to deployment, the end user must contact an Iridium service provider to activate this device with an Iridium account. MetOcean recommends Joubeh Technologies, www.joubeh.com, contact sales@joubeh.com for more information.
- Failure to activate this device with an Iridium VAR will result in no data transmission from the unit.
- Contact tech support support@metocean.com should there be any questions or concerns.

WARRANTY POLICY

MetOcean warrants products manufactured by MetOcean to be free from defects in materials and workmanship under normal use and service for twelve (12) months from the date of shipment, unless specified otherwise, subject to the following conditions:

MetOcean's obligation under this warranty is limited to repairing or replacing (at MetOcean's option) products that have been returned prepaid to MetOcean. MetOcean will return warranted equipment by surface carrier, prepaid. This warranty shall not apply to any MetOcean products that have been subjected to modification, misuse, neglect, accidents of nature, or shipping. Batteries are not warranted. Under no circumstance will MetOcean reimburse the claimant for costs incurred in removing and / or reinstalling equipment. This warranty, and MetOcean's obligation hereunder, is in lieu of all other warranties, expressed or implied, including warranties of suitability and fitness for a particular purpose. MetOcean is not liable for consequential damages.

REVISION TABLE

Version	Description of Change	Author of Change	Date of Change
1.0	Initial Release	A. Lowery	3/1/2010
1.1	Ascent speed correction	A. Lowery	4/12/2012
2.0	Added new CTD sampling and binning	B. Petolas	1/25/2013
2.1	Change Accuracy listing of the SBE41CP sensor	A. Widdis	12/10/2013
3.0	Added specifications for DOVA	A.Widdis	07/11/2014
4.0	Added specifications for NAMI	A.Widdis	20/03/2015

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INTRODUCTION

The MetOcean Data System Profiling Floats are compact light weight systems designed to acquire upwards of 200 profiles from depths of down to 2000 m over the course of 5 years using a variety of different sensors. MetOcean Data Systems has an online lifetime estimator to show the user what impact changing the mission parameters would have on the life expectancy of the float. This tool is located here: http://www.metocean.com/LifetimeEstimator/.

After launch, the float's mission consists of a first day profile which transitions into a repeating cycle of descent, submerged drift, ascent and data transmission. During these cycles, the float dynamically controls its buoyancy with a hydraulic system. This hydraulic system adjusts the density of the float causing it to descend, ascend or hover at a constant depth in the ocean.

The user can specify the depth at which the system drifts between descent and ascent profiles, this drifting depth is referred to as parking depth. The float continually samples the pressure at parking depth and maintains that depth within approximately 30 m. After drifting at parking depth the float proceeds to the depth at which the ascending profile is to begin. The ascent profile starting depth is not necessarily the same as the parking depth.

During its mission, the float collects measurements and saves them in its memory. These measurements can be made during the submerged drift period (Lagrangian operation) and during the ascent (ascent profile). After each ascent, the float determines its location at the surface with a GPS receiver. The float then transmits its saved data, including the GPS position, to the Iridium satellite system using Iridium's short burst data (SBD) service. Since a significant volume of data can be sent quickly and cost effectively the depth resolution can be much greater than has been traditionally possible with profiling floats.

Figure 1 : Profiling Float

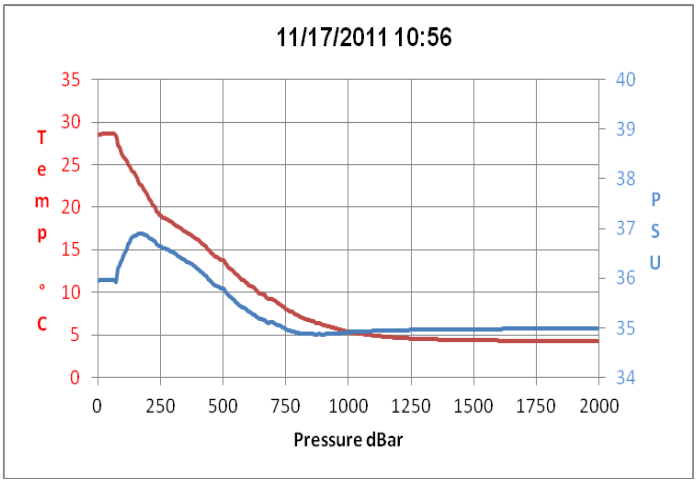

Figure 2 : A sample CTD profile.

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SPECIFICATIONS: NOVA

<table>
<tr><td>Operational</td><td>Temperature range: -2°C to 35°C

Pressure at parking depth: 40 bar to 200 bar (~400 to 2000 m depth)

Depth maintenance accuracy: ±3 bar typical (adjustable)

Survival at sea: ~200 profiles or up to 5 years

Duration of a cycle: up to 10 days

Shelf Life: Up to 5 years at -20°C to 50°C

Telemetry: Iridium 9602 SBD Transceiver

Deployment: Fantail ready once magnet is removed

Buoyancy Control System: Hydraulic

User Interface: Bluetooth Graphical User Interface to PC</td></tr>
<tr><td>Mechanical</td><td>Over-all height: 134 cm / 52.8 in

Diameter of Hull: 16.5 cm / 6.50 in

Weight: 21 kg / 46.3 lbs

Material: Hard Anodized Aluminium</td></tr>
<tr><td>Sensors</td><td>The NOVA Profiling Float uses the Sea-Bird SBE 41CP CTD Sensor. The SBE 41CP is specifically developed for profiling floats and is widely accepted in the ARGO Float community. SBE 41CP sensor Specifications:

<table>
<tr><th></th><th>Range</th><th>Accuracy</th><th>Resolution</th></tr>
<tr><td>Salinity</td><td>2 psu to 42 psu</td><td>±0.002 psu</td><td>0.001 psu</td></tr>
<tr><td>Temperature</td><td>-5°C to 45°C</td><td>±0.002 °C</td><td>0.0001°C</td></tr>
<tr><td>Pressure</td><td>0 bar to 200 bar</td><td>±2 dbar</td><td>0.04 dBar</td></tr>
</table>
</td></tr>
<tr><td>Shipping</td><td>The NOVA Profiling Float uses a 30 D Cell Lithium Battery pack. This battery pack is certified in accordance with the United Nations Recommendations on the Transport of Dangerous Goods: Manual of Tests and Criteria, ST/SG/AC 10/11 Rev. 4 in compliance with UN3090 Classification. A copy of this certificate is available from MetOcean, contact sales@metocean.com if required.

Note: Consult local shipping regulations before transporting the Profiling Float.</td></tr>
</table>

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SPECIFICATIONS: DOVA

Operational

Temperature range: -2°C to 35°C

Pressure at parking depth: 40 bar to 200 bar (~400 to 2000 m depth)

Depth maintenance accuracy: ±3 bar typical (adjustable)

Survival at sea: ~200 profiles or up to 5 years

Duration of a cycle: up to 10 days

Shelf Life: Up to 5 years at -20°C to 50°C

Telemetry: Iridium 9602 SBD Transceiver

Deployment: Fantail ready once magnet is removed

Buoyancy Control System: Hydraulic

User Interface: Bluetooth Graphical User Interface to PC

Mechanical

Over-all height: 136.7 cm / 53.8 in

Diameter of Hull: 16.5 cm / 6.50 in

Weight: 22 kg / 48.7 lbs

Material: Hard Anodized Aluminium

Sensors

The DOVA Profiling Float uses the Sea-Bird SBE 41CP CTD Sensor with a mechanically integrated SBE 63 Optical Dissolved Oxygen sensor. SBE 41CP sensor Specifications:

	Sensor	Range	Accuracy	Resolution
Salinity	41CP	2 psu to 42 psu	±0.002 psu	0.001 psu
Temperature	41CP	-5°C to 45°C	±0.002 °C	0.0001°C
Pressure	41CP	0 bar to 200 bar	±2 dbar	0.04 dbar
Dissolved Oxygen (Reported in Phase)	63ODO	0 to 450 µmol/kg oxygen	larger of ±3µmolkg or ±2%	0.2µmol/kg

Shipping

The DOVA Profiling Float uses a 30 D Cell Lithium Battery pack. This battery pack is certified in accordance with the *United Nations Recommendations on the Transport of Dangerous Goods: Manual of Tests and Criteria, ST/SG/AC 10/11 Rev. 4* in compliance with UN3090 Classification. A copy of this certificate is available from MetOcean, contact sales@metocean.com if required.

Note: Consult local shipping regulations before transporting the Profiling Float.

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SPECIFICATIONS: NAMI

<table>
<tr><td>Operational</td><td>Temperature range: -2°C to 35°C

Pressure at parking depth: 40 bar to 200 bar (~400 to 2000 m depth)

Depth maintenance accuracy: ±3 bar typical (adjustable)

Survival at sea: ~200 profiles or up to 5 years

Duration of a cycle: up to 10 days

Shelf Life: Up to 5 years at -20°C to 50°C

Telemetry: Iridium 9602 SBD Transceiver

Deployment: Fantail ready once magnet is removed

Buoyancy Control System: Hydraulic

User Interface: Bluetooth Graphical User Interface to PC</td></tr>
<tr><td>Mechanical</td><td>Over-all height: 145 cm / 57 in

Diameter of Hull: 16.5 cm / 6.50 in

Weight: 22 kg / 48 lbs

Material: Hard Anodized Aluminium</td></tr>
<tr><td>Sensors</td><td>The NAMI Profiling Float uses the RBRargo CTD Sensor. The RBRargo CTD is specifically developed for profiling floats with state of the art electronics and sensors. RBRargo CTD sensor Specifications:

<table>
<tr><th></th><th>Range</th><th>Accuracy</th><th>Resolution</th></tr>
<tr><td>Conductivity</td><td>0-85mS/cm</td><td>±0.003mS/cm</td><td>~1µS/cm</td></tr>
<tr><td>Temperature</td><td>-5°C to 35°C</td><td>±.002 °C</td><td>0.00005°C</td></tr>
<tr><td>Pressure</td><td>0 bar to 200 bar</td><td>±1 dbar</td><td><0.02 dBar</td></tr>
</table>
</td></tr>
<tr><td>Shipping</td><td>The NOVA Profiling Float uses a 30 D Cell Lithium Battery pack. This battery pack is certified in accordance with the United Nations Recommendations on the Transport of Dangerous Goods: Manual of Tests and Criteria, ST/SG/AC 10/11 Rev. 4 in compliance with UN3090 Classification. A copy of this certificate is available from MetOcean, contact sales@metocean.com if required.

Note: Consult local shipping regulations before transporting the Profiling Float.</td></tr>
</table>

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DEPLOYMENT

ATTENTION – Device Activation

Prior to deployment, the end user must contact an Iridium service provider to activate this device with an Iridium account via Iridium. MetOcean recommends JouBeh Technologies, www.joubeh.com, contact sales@joubeh.com for more information. Failure to activate this device with an Iridium VAR will result in no data transmission from the unit.

Fantail Ready

All Profiling Floats are shipped fantail ready for immediate deployment. On magnet removal, a self-check is performed and a house-keeping message is sent. No connections are required and no commands need to be issued by PC or by satellite. All Floats are programmed to park at 1000 m and profile to 2000 m on both the first day of the deployment, and every 10 days thereafter. Contact support@metocean.com should there be any questions or concerns.

Pre-Deployment Check

All MDS floats may undergo a pre-deployment check. MDS recommends the following procedures:

1. Remove the magnet on the top cap.
2. Establish communication with the float's Bluetooth communication protocol
3. Check the LEVEL of the internal bladder. If it is EMPTY proceed to step 5. If it reports FULL proceed to step 4.
4. Execute an EMPTY command. This will ensure the buoy is as buoyant as possible
5. Check the internal VACUUM. If the reading is comparable to current atmospheric conditions there may be an air leak in the float. Contact support@metocean.com if this is the case.
6. Either replace the magnet if returning to storage, or deploy following the deployment instructions.

Turning the NOVA Float On

First the operator must remove any plugs from the sensor (NOVA & DOVA). To activate the Profiling Float, the operator must remove the magnet at the top of the unit. Once the magnet is removed the unit is operational and may be deployed into the water.

Full and illustrated deployment instructions are listed in *Table 1: Deployment Instructions*

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Table 1: Deployment Instructions

Step 1	Step 2	Step 3
		
Remove Any Plugs From Sensors on the Top Cap (e.g. Seabird Sensor)	Remove Magnet from top of Float	Identify The Slots On The Float (Top and Bottom)

Step 4	Step 5
	
Pass A Rope Through Slots Lower Float Into Water While Maintaining Tension At All Times	Release One End Of The Rope To Ease Tension And Deploy The Float

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PROFILING FLOAT OPERATION

Mission

The Mission begins with the deployment of the float. During the Mission, the float conducts a pre-programmed number of cycles of descent, drift at parking depth, ascent and data transmission. During these cycles it collects data for transmission during the surface interval at the end of each cycle. The float measures surface pressure on every cycle. If this value differs from 0dBar, then a firmware correction is made to eliminate the offset. Each reset is captured and transmitted in the profiling housekeeping message at the CTD Pressure Offset row.

After the magnet has been removed the float will perform internal testing. Upon successful completion of this test the float will obtain a GPS fix and transmit a housekeeping message by Iridium, and activate the valve ten times. The unit is now ready to begin its first cycle. There is a prescribed delay before descent on the Profiling Float's first cycle in order to prevent premature hydraulic action during deployment. This delay only occurs on the first mission.

In its default configuration, the float will conduct a first day cycle where it will descend to 2000 m, and conduct a typical profile. Once it surfaces, it will transmit all of its data and transition into its 10 day cycle period until it reaches its end of life. One cycle is shown in ***Error! Reference source not found.****: A schematic representation of Profiler's depth-cycling during the Mission,* the labeled sections of the figure are described thereafter.

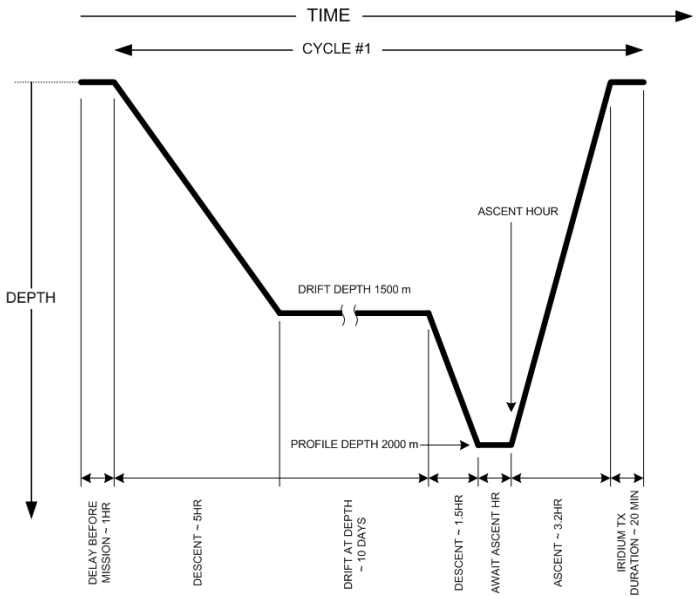

Figure 3: A schematic representation of the Profiler's depth-cycling during the Mission

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Descent

The float descends at an average speed of 60 cm/s. During descent, which typically lasts a few hours, the float can detect possible grounding on a high portion of the seabed and can move away from such places. During this time the unit can collect sensor data down-cast profile, if desired.

Drifting at Parking Depth

During the drift period, the float drifts at a user-selected drift depth, typically 1000 m to 1500 m below the sea surface. The drift period is user-selectable and can last from 1 to 10 days (default setting is 10 days). The float automatically adjusts its buoyancy if it drifts from the selected depth by more than 3 bar over a 60-minute period. The float can collect measurements at user-selected intervals during this drift period if the user selects this option.

Descent to Profile Depth

The user may select a starting depth for the ascent profile that is deeper than the drift depth. In this case the float will descend to the profile depth before beginning the ascent profile. The float can detect a possible grounding during this descent and take corrective action.

Wait for Ascent Time

The user can program several floats to conduct profiles simultaneously. This makes it possible to use several floats in a network of synoptic measurements, even though the instruments are not all deployed at the same time. If this is the case, it may be necessary for the floats to standby at the profile starting depth while waiting for the scheduled ascent time.

Ascent

Ascent lasts a few hours, during which time the float ascends to the sea surface at an average speed of 15 cm/s. This is the primary phase of the mission for the collection of sensor data.

Transmission

At the end of each cycle, the float generates sufficient buoyancy to ensure the antenna is well clear of the surface to allow trouble free data transmission. Since Iridium data transfers are generally very fast the float needs to spend only about 20 minutes on the surface where it is vulnerable to shipping and fishing hazards. Most of the surface time is devoted to the process of gaining and losing buoyancy.

Life Expiry

Life Expiry begins automatically upon completion of the pre-programmed number of cycles. During Life Expiry, the float, drifting on the sea surface, periodically transmits messages until the battery is depleted. Reception of these messages

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makes it possible to locate the float, to follow its movements and, if desired, to recover it. The floats are designed to be expendable, so recovery is not part of its normal life cycle.

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DATA TRANSMISSION

The Profiling Float creates transmission messages from the stored data. The data is organized into five types of packets summarized in *Table 2: Data Packets*. For complete details on the data packet structure see Appendix A.

Table 2: Data Packets

Data Packet	Model	Included Data	MDS Controlled Document
Housekeeping	NOVA & NAMI	GPS, Battery voltage and data summary information	FID 4051, MDS TD 12-040
	DOVA		FID 4069, MDS TD 14-001
Hydraulic	ALL	Pressure versus time for the last cycle	FID 4044, MDS TD 12-003
Descent CTD	NOVA & NAMI	CTD data gathered during descent	FID 4043, MDS TD 12-002
	DOVA		FID 4070, MDS TD 14-002
Parking CTD	NOVA & NAMI	CTD data gathered during drift at parking	FID 4043, MDS TD 12-002
	DOVA		FID 4070, MDS TD 14-002
Ascent CTD	NOVA & NAMI	CTD data gathered during ascent	FID 4043, MDS TD 12-002
	DOVA		FID 4070, MDS TD 14-002
Acknowledgement	ALL	PARAM Values	FID 4045, MDS TD 12-004

Only a single packet is required for the housekeeping and the hydraulic data packets. The ascent and descent sensor data may consist of up to 10 individual packets. The parking packet type is limited to a maximum only 4 packets. The transmission of each packet of Iridium data is repeated a maximum of 20 times or until the packet is successfully sent and acknowledged by the Iridium network. There is delay of 20 seconds programmed between attempts.

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MISSION PARAMETERS

The float's configuration is determined by the values of its mission parameters defined in *Table 4: Mission Parameters*. Each mission parameter has a minimum, maximum and a default value listed. The default values listed are how the Profiling Floats are programmed when they leave the factory. The mission parameters can be changed using the MDS PROFILING FLOAT CONFIGURATION MANAGER and a Bluetooth connection, or through an OTA command.

Any changes to the mission parameters should be reviewed carefully before executing to ensure your float functions properly.

Table 3: Mission Parameters

	Description	Min	Max	Default	Notes
PARAM 0	Cycle Period (DAYS)	0	10	10	The duration of one cycle of descent, submerged drift, ascent and transmission. The NOVA Profiling Float waits submerged at the parking depth for as long as necessary to make the cycle the selected duration.
PARAM 1	Number of Cycles	0	255	255	This is the number of cycles of descent, submerged drift, ascent and transmission that NOVA will perform. The mission ends and NOVA enters Life Expiry mode when this number of cycles has been completed. **Note:** when PARAM 1 = 255 the number of cycles in infinite.
PARAM 2	Ascent Time (HOURS)	0	23	VARIOUS	GMT hour of the day to begin ascent profiles, according to 24-hour clock.
PARAM 3	Ascent Sampling Period (SECONDS)	0	10	10	The time interval between successive measurements during ascent.
PARAM 4	Descent Sampling Period (SECONDS)	0	10	0	The time interval between successive measurements during descent.
PARAM 5	Parking Sampling Period (HOURS)	0	24	24	The time interval between successive measurements during NOVA's stay at the drift depth.
PARAM 6	Parking Depth	0	2000	1000	The depth at which NOVA drifts after completion of a descent while awaiting the time scheduled for the beginning of the

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	(DBAR)				next ascent.
PARAM 7	Profile Depth (DBAR)	0	2000	2020	Depth to begin profiling, if an ascending profile, and the ending depth, if a descending profile. If NOVA is drifting at some shallower depth, it will first descend to the profile depth before starting the ascent profile.
PARAM 8	Duration from Parking to Profile Depth (HOURS)	0	24	6	The number of hours before the Ascent time (PARAM 2) that parking will end.
PARAM 9	Depth Interval for CTD Data Reduction (DBAR)	0	100	5	The target depth interval between final CTD samples. A small interval gives a more highly resolved profile and larger messages.
PARAM 10	Reserved for future applications, always set to 0				
PARAM 11					
PARAM 12	Delay Before Mission (MINUTES)	0	60	15	The time delay between activation and the float becoming operational on its mission.
PARAM 13	End of Life Message Interval (MINUTES)	10	360	30	The interval between housekeeping messages at the end-of-life.
PARAM 14	Reference Day	0	10	0	Set this to zero (0) to set an immediate profile post deployment, after which the cycle period applies.

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HIDDEN PARAMETERS

The following list of Hidden Parameters may be changed through the MDS PROFILING FLOAT CONFIGURATION MANAGER or the JouBeh back office. All other Hidden Parameters are locked down and may only be changed with the assistance of MetOcean Technical Support.

Any changes to the mission parameters should be reviewed carefully before executing to ensure your float functions properly. Changing Bin sizes may increase both the number of SBD messages and the amount of data transmitted via the Iridium network potentially increasing your bill. Please contact **support@Metocean.com** for more details.

Table 4: Hidden Parameters

	Description	Min	Max	Default	Notes
HPARAM 0	HPARAM 0 to HPARAM 28 are reserved for factory setup and are not user changeable				
HPARAM 28					
HPARAM 29		0	32767	10	Top bin interval in CBars
HPARAM 30		0	32767	980	Top bin size in CBars
HPARAM 31		0	32767	1000	Top bin max in CBars
HPARAM 32		0	32767	25	Middle bin interval in CBars
HPARAM 33		0	32767	3975	Middle bin size in CBars
HPARAM 34		0	32767	5000	Middle bin max in CBars
HPARAM 35		0	32767	50	Bottom bin interval in CBars
HPARAM 36		0	32767	14950	Bottom bin size in CBars
HPARAM 37	HPARAMS 37 and 38 are reserved for factory setup and are not user changeable				

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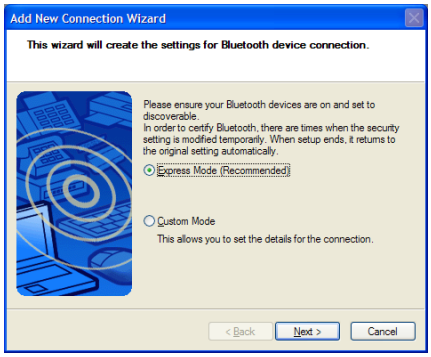
ADVANCED FEATURES

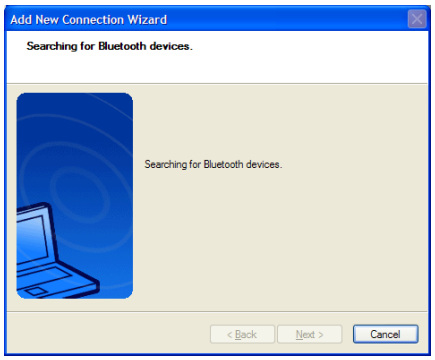
Setting up the Bluetooth Connection

Follow the steps listed in *Table 5: Bluetooth Device Setup* and *Table 6: Bluetooth Connection with Float Setup* in order to establish a Bluetooth connection with the Profiling Float.

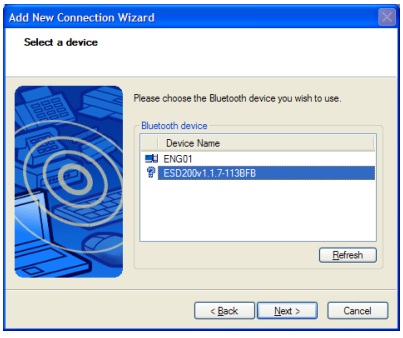
Table 5: Bluetooth Device Setup (on a PC, Windows 7.0 shown as typical)

Step 1: Double Click on Bluetooth Icon on Task Bar, hit 'New Connection'

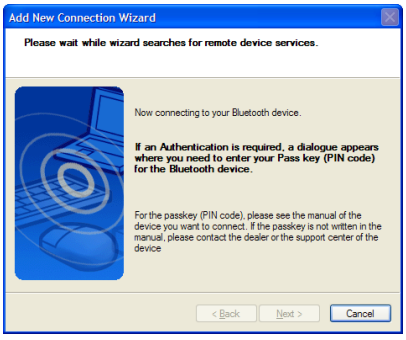


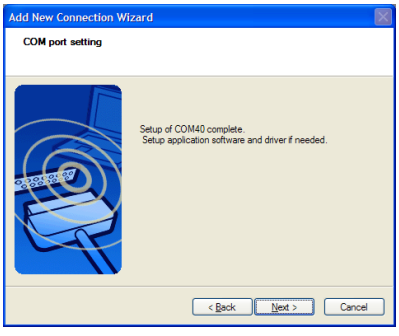


Step 2: Follow recommended steps in 'Add New Connection Wizard'



Step 3: Select Bluetooth Device





Step 4: Continue steps in 'Add New Connection Wizard'

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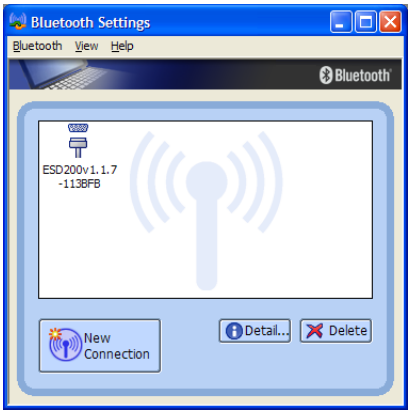
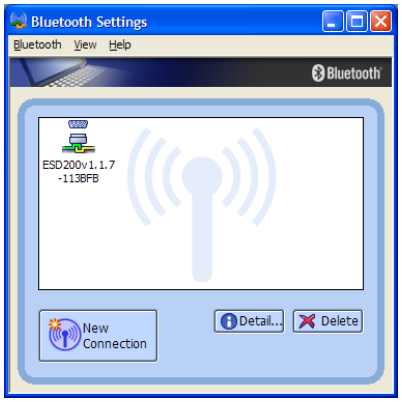
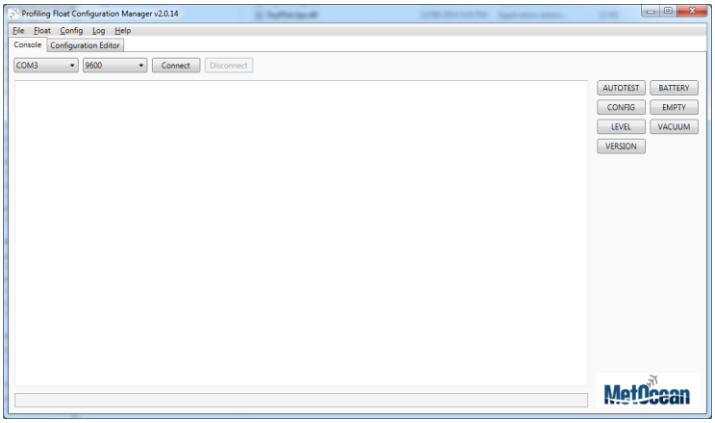
Table 6: Bluetooth Connection with Float Setup (on a PC, Windows 7.0 shown as typical)



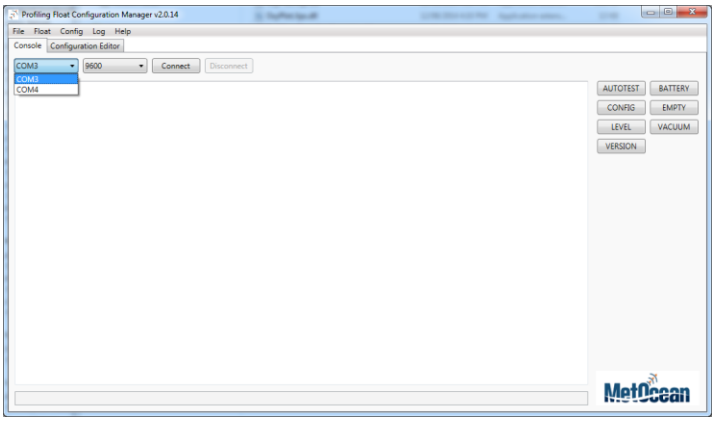
Step 1: Double Click on Bluetooth Icon on Task Bar



Step 2: Right Click on Device Icon and select 'Connect'



Step 3: Open MDS PROFILING FLOAT CONFIGURATION MANAGER



Step 4: Select Bluetooth Device's COM Port and select 'Connect'

Having followed the steps in *Table 5: Bluetooth Device Setup* and *Table 6: Bluetooth Connection with Float Setup* you will have established a connection between the Profiling Float and the MDS PROFILING FLOAT CONFIGURATION MANAGER. Note that the Bluetooth specific setup wizard and screens may vary depending on your system and Bluetooth device.

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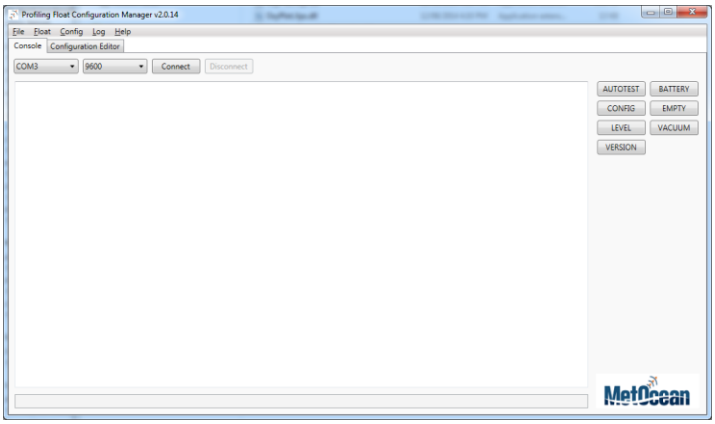
Modifying the Profile

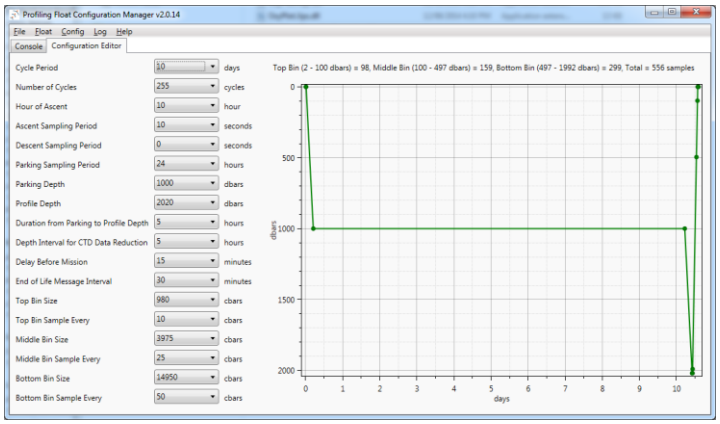
The Mission Parameters and their default values are listed in *Table 4: Mission Parameters.* Each of the parameters can be modified prior to deployment using the MDS PROFILING FLOAT CONFIGURATION MANAGER. Establish a connection between the Profiling Float and the MDS PROFILING FLOAT CONFIGURATION MANAGER using the steps listed in *Table 5: Bluetooth Device Setup* and *Table 6: Bluetooth Connection with Float Setup.*

Ensure that the Profiling Float is turned on by removing the magnet from the top of the float.

In order to change the float's mission parameters, enter PARAM XX YY into the GUI's command line. XX represents the parameter number and YY represents the new value. For example, to change the profiling depth to 1,500 dbar enter 'PARAM 7 1500.'

Following any profile modifications, use the quick option on the right side of the GUI window 'Level' to confirm that the internal oil bladder is 'EMPTY' by hitting the 'Level' button. If the response is anything but 'EMPTY' use the 'Empty' command button as required to empty the internal bladder. This may take more than one attempt. When the profile modifications are complete, replace the magnet to turn off the unit until ready to deploy.





Console Window **Config Window**

Figure 4: The PROFILING FLOAT CONFIGURATION MANAGER

Over the Air (OTA) Commands

Adjustment to the Float's mission parameters post deployment is possible through OTA Commands. Contact support@metocean.com for details.

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ARGO TRAJECTORIES

Figure 5: Argo Trajectories shows the different Argo time parameters on a profile. *Table 7: Argo Parameters* lists the description of each Argo parameter, and the Metocean Profiling Float equivalent.

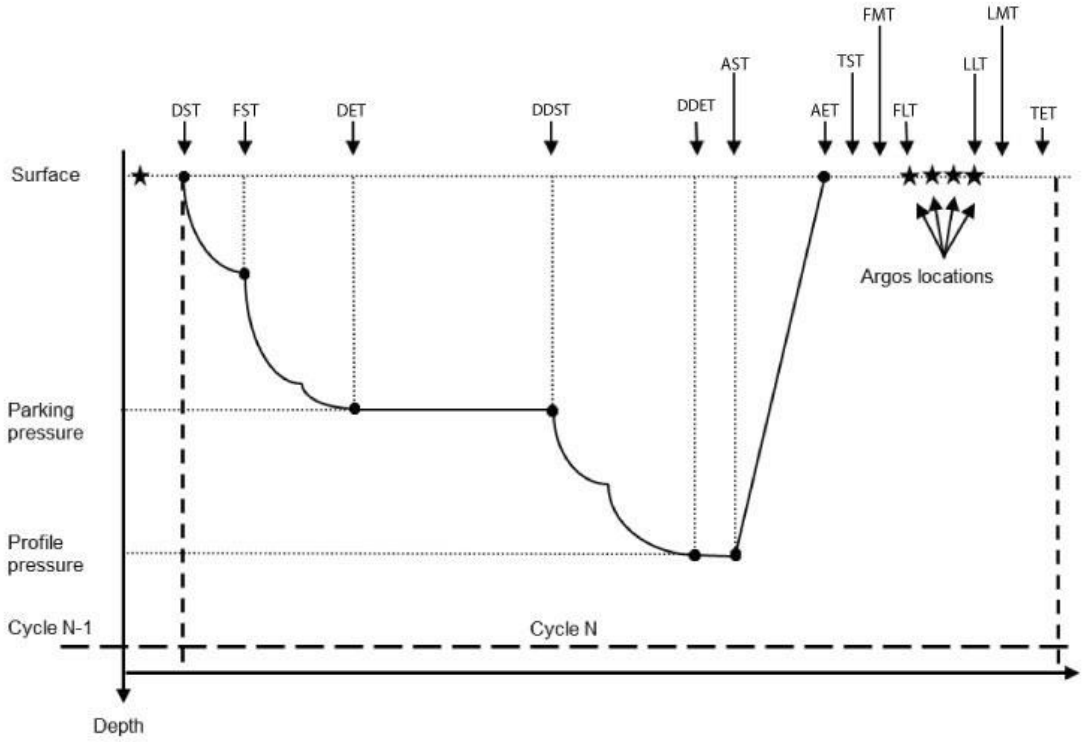

Figure 5: Argo Trajectories

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Table 7: Argo Parameters

Parameter	Description	MetOcean Name
DST	Descent Start Time	NVS ÷ 3 (See Note 1)
FST	First Stabilization Time	FST
DET	Descent End Time	EDT
DDST	Deep Descent Start Time	DDST
DDET	Deep Descent End Time	DDET
AST	Ascent Start Time	SAT
AET	Ascent End Time	EAT
TST	Transmission Start Time	See Note 2
FMT	First Message Time	See Note 2
FLT	First Location Time	See Note 2
LLT	Last Location Time	See Note 2
LMT	Last Message Time	See Note 2
TET	Transmission End Time	See Note 2
	GPS activation time	TTFF
	Short burst Data activation time	SBDT

Note 1: We do not track or report this parameter. However, it can be calculated by dividing parameter NVS by 3 and adding this number of minutes to the time stamp of the previous Iridium transmission.

Note 2: For iridium, there are two values transmitted that replace the Argos transmission time. When the float reaches the surface, it acquires a GPS position. The time to do this is represented by TTFF (in seconds). After the GPS is acquired, then the Iridium transceiver is activated. The time to do this is represented by SBDT (again in seconds). After completion of the transmission, a satellite check is done to look for incoming commands. If there is one, it is processed and then the float starts its next profile. Note that SBDT refers to the previous profile, not the current one, as it is calculated AFTER the Iridium transmission takes place.

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Appendix A: Message Format

Housekeeping Message

FID 4051 (NOVA & NAMI)

Data Name	Description	Units	Min	Max	Start byte	Bit Length	Decoding Equation
MSG_ID	Packet Identity, 1 = Housekeeping	-	1	1	1	8	y = x
NB_BYTES	Number of bytes in message	-	75	75	2	16	y = x
EDT	Time in the day when the float ended it descent to parking	hour	0	23.999	4	16	y = 0.001 * x
FST	Time in the day when the float first activated the valve during its descent	hour	0	23.999	6	16	y = 0.001 * x
DDST	Time in the day when the float started its descent to profile depth	hour	0	23.999	8	16	y = 0.001 * x
DDET	Time in the day when the float achieved its profile depth	hour	0	23.999	10	16	y = 0.001 * x
SAT	Time in the day when the float started it s ascending profile	hour	0	23.999	12	16	y = 0.001 * x
EAT	Time in the day when the float ended it s ascending profile	hour	0	23.999	14	16	y = 0.001 * x
NVS	Number of valve activations at surface	--	0	255	16	8	y = x
NVDPA	Number of valve activations during the descent to parking	--	0	255	17	8	y = x
NPDPA	Number of pump activations during the descent to parking	--	0	255	18	8	y = x
NVDPR	Number of valve activations during the descent to profile	--	0	255	19	8	y = x
NPDPR	Number of pump activations during the descent to profile	--	0	255	20	8	y = x
NPA	Number of pump activations during the ascent to surface	--	0	255	21	8	y = x
NDCPA	Number of depth corrections during parking	--	0	255	22	8	y = x
NEPAZ	Number of entries in parking zone	--	0	255	23	8	y = x
FSPD	First stabilization pressure during descent	bar	0	255	24	8	y = x
MAPPA	Maximum pressure recorded during parking	bar	0	255	25	8	y = x
MIPPA	Minimum pressure recorded during	bar					

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	parking		0	255	26	8	y = x
MAP	Maximum pressure recorded during the cycle	bar	0	255	27	8	y = x
NPD	Number of CTD points in descent profile	--	0	65535	28	16	y = x
NMD	Number of messages in descent profile	--	0	255	30	8	y = x
NPA	Number of CTD points in ascent profile	--	0	65535	31	16	y=x
NMA	Number of messages in ascent profile	--	0	255	33	8	y=x
NPAA	Number of CTD points in parking	--	0	65535	34	16	y=x
NMPA	Number of messages in parking	--	0	255	36	8	y=x
NMPS	Number of messages in pressure	--	0	255	37	8	y=x
PO	CTD pressure offset	dBar	-3276.8	3276.7	38	16	y=0.1*x-3276.8
IV	Internal vacuum	mBar	0	65535	40	16	y=x
GDS	Ground detection at surface	--	0	1	42	8	y=x
GDD	Ground detection during descent	--	0	1	43	8	y=x
CN	Cycle Number	--	0	255	44	8	y=x
BV	Battery Voltage	Volts	0	25.5	45	8	y=0.1*x
NPRCTD	Number of power resets CTD	--	0	255	46	8	y=x
NFACTD	Number of failed acquisitions CTD	--	0	255	47	8	y=x
EFCTD	CTD Command error flag	--	0	255	48	8	y=x
NPRI	Number of power resets Iridium	--	0	255	49	8	y=x
NIPQ	Number of incoming Iridium packets received during previous session	--	0	255	50	8	y=x
NPRG	Number of power resets GPS	--	0	255	51	8	y=x
GPSLAT	GPS Latitude	degrees	-90	90	52	32	y=1E-7*x-214.7483648
GPSLONG	GPS Longitude	degrees	-180	180	56	32	y=1E-7*x-214.7483648
DLF	Day of month of last GPS fix	day	1	31	60	8	y=x
TLF	Time of last GPS fix	hour	0	23.999	61	16	y=0.001*x
EA	Emergency ascent flag	--	0	1	63	8	y=x
WTO	Watchdog timeout flag	--	0	1	64	8	y=x
NPPM	Number of hydraulic records	--	0	255	65	8	y=x
DTSC	Date and time at the start of the cycle	hour	0	23.999	66	16	y=0.001*x
		day	1	31	68	8	y=x
		month	1	12	69	8	y=x
		year	0	255	70	8	y=x+2000
TTFF	Time to last GPS fix	seconds	0	900	71	16	y=x
SBDT	Time needed to transmit last Housekeeping packet	seconds	0	510	73	8	y=2*x

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FID 4069 (DOVA)

Data Name	Description	Units	Min	Max	Start byte	Bit Length	Decoding Equation
MSG_ID	Packet Identity, 1 = Housekeeping	-	1	1	1	8	y = x
NB_BYTES	Number of bytes in message	-	75	75	2	16	y = x
EDT	Time in the day when the float ended it descent to parking	hour	0	23.999	4	16	y = 0.001 * x
FST	Time in the day when the float first activated the valve during its descent	hour	0	23.999	6	16	y = 0.001 * x
DDST	Time in the day when the float started its descent to profile depth	hour	0	23.999	8	16	y = 0.001 * x
DDET	Time in the day when the float achieved its profile depth	hour	0	23.999	10	16	y = 0.001 * x
SAT	Time in the day when the float started it s ascending profile	hour	0	23.999	12	16	y = 0.001 * x
EAT	Time in the day when the float ended it s ascending profile	hour	0	23.999	14	16	y = 0.001 * x
NVS	Number of valve activations at surface	--	0	255	16	8	y = x
NVDPA	Number of valve activations during the descent to parking	--	0	255	17	8	y = x
NPDPA	Number of pump activations during the descent to parking	--	0	255	18	8	y = x
NVDPR	Number of valve activations during the descent to profile	--	0	255	19	8	y = x
NPDPR	Number of pump activations during the descent to profile	--	0	255	20	8	y = x
NPA	Number of pump activations during the ascent to surface	--	0	255	21	8	y = x
NDCPA	Number of depth corrections during parking	--	0	255	22	8	y = x
NEPAZ	Number of entries in parking zone	--	0	255	23	8	y = x
FSPD	First stabilization pressure during descent	bar	0	255	24	8	y = x
MAPPA	Maximum pressure recorded during parking	bar	0	255	25	8	y = x
MIPPA	Minimum pressure recorded during parking	bar	0	255	26	8	y = x
MAP	Maximum pressure recorded during the cycle	bar	0	255	27	8	y = x
NPD	Number of CTD points in descent	--	0	65535	28	16	y = x

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	profile						
NMD	Number of messages in descent profile	--	0	255	30	8	y = x
NPA	Number of CTD points in ascent profile	--	0	65535	31	16	y=x
NMA	Number of messages in ascent profile	--	0	255	33	8	y=x
NPAA	Number of CTD points in parking	--	0	65535	34	16	y=x
NMPA	Number of messages in parking	--	0	255	36	8	y=x
NMPS	Number of messages in pressure	--	0	255	37	8	y=x
PO	CTD pressure offset	dBar	-3276.8	3276.7	38	16	y=0.1*x-3276.8
IV	Internal vacuum	mBar	0	65535	40	16	y=x
GDS	Ground detection at surface	--	0	1	42	8	y=x
GDD	Ground detection during descent	--	0	1	43	8	y=x
CN	Cycle Number	--	0	255	44	8	y=x
BV	Battery Voltage	Volts	0	25.5	45	8	y=0.1*x
NPRCTD	Number of power resets CTD	--	0	255	46	8	y=x
NFACTD	Number of failed acquisitions CTD	--	0	255	47	8	y=x
EFCTD	CTD Command error flag	--	0	255	48	8	y=x
NPRI	Number of power resets Iridium	--	0	255	49	8	y=x
NIPQ	Number of incoming Iridium packets received during previous session	--	0	255	50	8	y=x
NPRG	Number of power resets GPS	--	0	255	51	8	y=x
GPSLAT	GPS Latitude	degrees	-90	90	52	32	y=1E-7*x-214.7483648
GPSLONG	GPS Longitude	degrees	-180	180	56	32	y=1E-7*x-214.7483648
DLF	Day of month of last GPS fix	day	1	31	60	8	y=x
TLF	Time of last GPS fix	hour	0	23.999	61	16	y=0.001*x
EA	Emergency ascent flag	--	0	1	63	8	y=x
WTO	Watchdog timeout flag	--	0	1	64	8	y=x
NPPM	Number of hydraulic records	--	0	255	65	8	y=x
DTSC	Date and time at the start of the cycle	hour	0	23.999	66	16	y=0.001*x
		day	1	31	68	8	y=x
		month	1	12	69	8	y=x
		year	0	255	70	8	y=x+2000
TTFF	Time to last GPS fix	seconds	0	900	71	16	y=x
SBDT	Time needed to transmit last Housekeeping packet	seconds	0	510	73	8	y=2*x
NPRDO	Number of power resets DO sensor	--	0	255	74	8	y=x
NFADO	Number of failed acquisitions DO sensor	--	0	255	75	8	y=x

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Hydraulic Message
FID 4044 (All Floats)

Data Name	Description	Units	Min	Max	Start byte	Bit Length	Decoding Equation
MSG_ID	Packet Identity, 2 = oldest pressure data 3 = continuation 2 4 = continuation 3	--	2	4	1	8	y = x
NB_BYTES	Number of bytes in message	--	0	340	2	16	y = x
CN	Cycle Number	--	0	255	4	8	y=x
P1	Pressure point 1	Bar	0	250	5	8	y = x
T1	Time from start of cycle	hours	0	6553.5	6	16	y = 0.1 * x
VALVE 1	Flag of 0xFFFF indicates a valve action, otherwise a pump event	--	0	65535	8	16	y = x
	Valve activation time	ms	0	32767	10	16	y = x
or PUMP 1 & RPM	Pump Activation Time	ds	0	32767	8	16	y = x
	RPM achieved during pump action	RPM	0	4923	10	16	y = x
P2	Pressure point 2	Bar	0	250	12	8	y = x
T2	Time from start of cycle	hours	0	6553.5	13	16	y = 0.1 * x
VALVE 2	Flag of 0xFFFF indicates a valve action, otherwise a pump event	--	0	65535	15	16	y = x
	Valve activation time	ms	0	32767	17	16	y = x
or PUMP 2 & RPM	Pump Activation Time	ds	0	32767	15	16	y = x
	RPM achieved during pump action	RPM	0	4923	17	16	y = x
…….							

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Sensor Data

FID 4043 (NOVA & NAMI)

Data Name	Description	Units	Min	Max	Start byte	Bit Length	Decoding Equation
MSG_ID	Packet Identity, 10 to 29 = ascent profile data 30 to 49 = descent profile data 50 to 55 = parking data	--	10	55	1	8	y = x
NB_BYTES	Number of bytes in message	--	0	340	2	16	y = x
CN	Cycle Number	--	0	255	4	8	y = x
TFSP	Time in the day of the first CTD sample	hour	0	23.9	5	8	y = 0.1 * x
S1	Salinity of the 1st CTD point	PSU	10	42.767	6	16	y = 0.001 * x + 10
T1	Temperature of the 1st CTD point	°C	-5	32.767	8	16	y = 0.001 * x - 5
P1	Pressure of the 1st CTD point	dBar	-10	2500	10	16	y = 0.1 * x -10
S2	Salinity of the 2nd CTD point	PSU	10	42.767	12	16	y = 0.001 * x + 10
T2	Temperature of the 2nd CTD point	°C	-5	32.767	14	16	y = 0.001 * x - 5
P2	Pressure of the 2nd CTD point	dBar	-10	2500	16	16	y = 0.1 * x -10
……							

FID 4070 (DOVA)

Data Name	Description	Units	Min	Max	Start byte	Bit Length	Decoding Equation
MSG_ID	Packet Identity, 10-29 : CTD-DO Ascent Packets 30-49 : CTD-DO Descent Packets 50-53 : CTD-DO Parking Packets	--	10	53	1	8	y = x
NB_BYTES	Number of bytes in message	--	5	355	2	16	y = x
CYCLE_NB	Cycle Number	--	0	255	4	8	y = x
TIME_1ST_SMPL	Time of the First Sample	hour	0	23.9	5	8	y = 0.1 * x
S1	Salinity 1st Sample	PSU	10	42.767	6	16	y = 0.001 * x + 10
T1	Temperature 1st Sample	degC	-5	32.767	8	16	y = 0.001 * x - 5
P1	Pressure 1st Sample	dBars	-10	2500	10	16	y = 0.1 * x -10

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PHASE DOXY1	SBE63 Raw Phase Value 1st Sample	us	0	65.535	12	16	y = 0.001 * x
TEMP DOXY1	SBE63 Thermistor Temperature 1st Sample	degC	-5	32.767	14	16	y = 0.001 * x - 5
S2	Salinity 2nd Sample	PSU	10	42.767	16	16	y = 0.001 * x + 10
T2	Temperature 2nd Sample	degC	-5	32.767	18	16	y = 0.001 * x - 5
P2	Pressure 2nd Sample	dBars	-10	2500	20	16	y = 0.1 * x -10
PHASE DOXY 2	SBE63 Raw Phase Value 2nd Sample	us	0	65.535	22	16	y = 0.001 * x
TEMP DOXY2	SBE63 Thermistor Temperature 2nd Sample	degC	-5	32.767	24	16	y = 0.001 * x - 5
...	...	...					

Acknowledgment
FID 4045 (All Floats)

Data Name	Description	Units	Min	Max	Start byte	Bit Length	Decoding Equation
MSG_ID	Packet Identity, 5 = Acknowledgment	--	5	5	1	8	y = x
NB_BYTES	Number of bytes in message	--	0	340	2	16	y = x
CMDT	Command type: 1 =PARAM or 2=HPARAM	--	1	2	4	8	y = 0.1 * x
PRMN	Number of the parameter or hparameter that was reprogrammed	--	0	255	5	8	y = 0.1 * x
VALUE	Value assigned to the parameter or hparameter	--	0	32767	6	16	y = 0.1 * x
STATUS	1: Command successful or 0: unsuccessful	--	0	1	8	8	y = 0.1 * x
.....							

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